

Appln No. 10/813,042

Reply to the Office Action dated August 5, 2005

REMARKS

Claims 1-21 are active in the present application. Reconsideration is respectfully requested.

Applicants' representative wishes to thank Examiner Boykin for the helpful and courteous discussion of October 25, 2005. As a result of the discussion it is believed that the issues in the case have been clarified and that the prosecution of the application has been materially advanced.

The present invention relates to a branched aromatic polycarbonate.

Claim Amendments

Claims 1 and 2 have been amended by specifying that the transesterification reaction that occurs is a melt transesterification. Claim 4 has been amended in order to clarify the relationship of the claim with the definition of the term " α " in the claim. None of the amendments to the claims are believed to have introduced new matter into the case. Entry of the amendments into the record is respectfully requested.

Background Considerations

In the preparation of a linear polymer by the condensation of two bi-functional units, except for the question of what the two terminal groups are on the end of the polymer chain, it appears that the only difference that exists between molecules is polymer chain length. This is the situation that exists for polycarbonate molecules that are prepared by the interfacial process (phosgene reacting with a diol). Here it is almost possible to adequately describe the polymer in terms of, for example, the value of a single property such as the viscosity average molecular

weight (Mv) of the polymer. However, in the case where a reaction medium contains a structural unit that is confronted with two or more other complementary reacting units, a non-linear polymer will form which makes it very problematic in providing a perfect description of the polymer molecule. This is the case for a polycarbonate that contains branched units in its polymer chain, such as a polycarbonate that is prepared by the melt transesterification process. It is impossible to adequately describe such a polymer in terms of a single value such as the Mv of the polymer. However, the Examiner in her remarks concerning the two cited and applied JP references, appears to reach the conclusion that the present aromatic polycarbonate is the same as the polycarbonates of the references that are also prepared by a melt transesterification process, because the viscosity average molecular weight range of 10,000 to 50,000 for the polycarbonate of the '067 reference overlaps the at least 16,000 viscosity average molecular weight range of the polycarbonate of the present invention and because the viscosity average molecular weight range of 10,000 to 20,000 for the polycarbonate of the '507 reference overlaps the at least 16,000 viscosity average molecular weight range of the polycarbonate of the present invention. However, for the reasons discussed above, no such conclusion that the polycarbonate of the present invention is the same as the polycarbonates of the two cited references can be reached!

The reasons why the polycarbonate of the invention is different from the each of the polycarbonates of the two references are as follows:

Two important characterizations of the polycarbonate of the invention are: (1) the high degree of branching within polymer molecules in view of the stated range of branched units of 0.3 mole % to not higher than 0.95 mole % based on 1 mole of non-branched structural units of the indicated formula in the claims, and (2) the broad molecular weight distribution with a

polydispersity Mw/Mn ranging from 2.8 to 4.5. This combination of polymer characterization means that the polycarbonate of the present invention has an appropriate melt tension which results in good blow molding of the polymer into shaped bottles, for example.

(It should be noted that the at least 16,000 viscosity average molecular weight range of the present claims corresponds to the viscosity average molecular weight ranges of ordinary polymers. In fact, many polycarbonates have viscosity average molecular weights within this range. Accordingly, in the present claims, this range of viscosity average molecular weight is used to exclude polymers that are not practically usable as a resin even if the factors (1) and (2) above are satisfied.)

The present invention, for the first time, provides a polycarbonate that is prepared by the melt process that is suitable for use in the blow molding of hollow containers. On the other hand, polycarbonates that are prepared by the interfacial process are known to be suitable for the blow molding of hollow containers. U. S. Patent 6,613,869 cited of record in the case, discloses a branched polycarbonate for the blow molding of hollow bottles. However, in order to produce such a polycarbonate containing branched structures, a branching agent must be employed during the polymerization. U. S. Patent 5,367,044, also cited of record, discloses a branched polycarbonate wherein a branching agent was used in the process of forming the polycarbonate that is suitable for use in blow molding.

The Examiner has stated that polycarbonates are commonly used for the blow molding of hollow container such as bottles. While this is true in the case of polycarbonates produced by the interfacial process which uses a branching agent, there has been no known polycarbonate that is prepared by the melt process that is suitable for hollow containers that satisfies both factors (1) and (2) of the present claims.

In order to prepare a polycarbonate that is suitable for hollow containers it is necessary to improve the molding properties of the polycarbonate such as the melt elastic modulus, the melt strength, and the like. In the case of polycarbonate that is prepared by the interfacial process, a polycarbonate of suitable molding properties is obtained by the employment of a branching agent. On the other hand, in the melt process, as described in the present specification, it is well known that transfer reactions proceed, as side reactions of the process, to produce branched structures. The fact that transfer reactions occur means essentially that it is more difficult to control the degree of branching in a melt process than is the case of the interfacial process that must employ a branching agent. Moreover, it is known that the polycarbonate that is obtained by the melt process that causes branching many times results in such problems as impaired hue and the presence of foreign matter in the polycarbonate, and the like. Because a high degree of branching in a polycarbonate is regarded as undesirable by those of skill in the art because of the problems mentioned immediately above, apparently no thought has been given to further increase the branching in such polymers beyond what is ordinarily obtained in melt polymerization processes. In other words, the present invention for the first time proposes the concept of controlled branching with such an objective in mind. With regard to this matter of control of the branching process, Claims 11-13 express important considerations as to the alkali metal or alkaline earth metal catalyst that is employed and the temperature in the final polymerizer. Other than these factors, other factors such as residence time and reaction pressure also may have an impact upon the branching that occurs.

Turning now to the '067 reference, the melt transesterification disclosed prepares a polycarbonate that is said to possess an excellent color hue and mechanical strength. The improvement in the hue of color results from the feeding in of inert gas to the reaction vessel.

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There is no description or suggestion anywhere of the degree of branching of the resulting polymer or of controlling the degree of branching in the reaction.

In this regard it is noteworthy to observe that in the examples, no use of a catalyst is taught or suggested, which, however, is one of the aspects of transesterification in the present process which influences control of branching. Moreover, in view of the attendant problem of color hue, an increase of branching is not believed to be something that was intended.

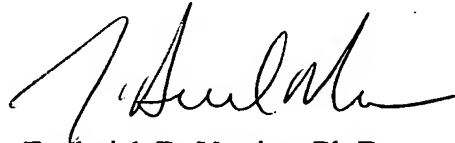
As to the '507 reference, the same discloses a polycarbonate that is intended for optical use. The reference describes a melt process of producing a polycarbonate having a viscosity average molecular weight ranging from 10,000 to 20,000 and having a terminal hydroxyl content of 1000 ppm or less. The product has a desirable color hue and contains little foreign matter, and there is no description or suggestion anywhere of branching in the polymer product or of a measure to be taken to enhance the degree of branching of the polymer. Further, the examples of the reference disclose polycarbonates that have comparatively small Mv's that range from 15500 to 19000. In fact, taking the viscosity data into account and the fact of the desirability of decreasing branching in the polymer in order to improve color hue and to reduce the level of foreign matter incorporation, it is clear that one of skill in the art would not be led to increase the degree of branching of the polymers disclosed in order to prepare a desirable product. Accordingly, the cited references do not anticipate the invention as claimed and withdrawal of the anticipatory grounds of rejection is respectfully requested.

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It is now believed that the application is in proper condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read "F. Vastine", written in a cursive style.

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